

What is claimed is:

1. A system for moving a simulated multi-articulated structure in relation to the movement of an analogous physical multi-articulated structure, where the simulated structure moves in a simulated environment comprising a simulated impediment to free motion, where the physical structure moves in an environment lacking an analogous physical impediment, said system comprising:

a device for measuring the configuration of the physical structure and the spatial placement of the physical structure relative to an inertial reference frame and providing digitized signals associated with said configuration and spatial placement; and

a data processor, comprising data related to the spatial placement of said simulated impediment, for receiving said digitized signals and modifying said signals to generate a set of modified signals specifying the configuration and spatial placement of the simulated structure, whereby the free motion of the simulated structure is impeded when encountering said simulated impediment.

2. A system for moving a simulated hand in relation to the movement of a physical hand, where the simulated hand moves in a simulated environment comprising a simulated impediment to free motion, where the physical hand moves in an environment lacking an analogous physical impediment, said system comprising:

a device for measuring the configuration of the hand and the spatial placement of the physical hand relative to an inertial reference frame and providing digitized signals associated with said configuration and spatial placement; and

a data processor, comprising data related to the spatial placement of said simulated impediment, for receiving said digitized signals and modifying said signals to generate a set of modified signals specifying the configuration and spatial placement of the simulated hand, whereby the free motion of the simulated hand is impeded when encountering said simulated impediment.

3. A system according to Claim 2, wherein said device comprises goniometers for measuring the angles of the joints of a physical hand, a tracking device for measuring the spatial placement of said hand relative to an inertial reference frame and means for mounting said device on said physical hand, said device providing digitized measured
5 signals associated with said angles and said spatial placement; and

said data processor producing modified signals from said digitized measured signals using a simulated spring attached between first and second simulated hands, where the angles and placement of said first simulated hand uses said digitized measured signals and the angles and placement of said second simulated hand uses said modified signals and
10 said first and second simulated hands are superimposed in the absence of said second simulated hand encountering said simulated impediment, said second simulated hand being depicted graphically as said simulated graphical hand;

whereby when said second simulated hand encounters said impediment, said second simulated hand is displaced from said first simulated hand and realigns with said second
15 simulated hand when said impediment is removed.

4. A system for moving a simulated graphical hand in relation to the movement of a physical hand, where the simulated graphical hand moves in a simulated environment comprising a simulated graphical impediment to free motion, where the physical hand moves
20 in an environment lacking an analogous physical impediment, said system comprising:

a device comprising goniometers for measuring the angles of the joints of a physical hand, a tracking device for measuring the spatial placement of said hand relative to an inertial reference frame and means for mounting said device on said physical hand, said device providing digitized measured signals associated with said angles and said spatial
25 placement; and

a data processor, comprising data related to the spatial placement of said simulated impediment, for producing modified signals from said digitized measured signals using a simulated spring-mass-dashpot attached between first and second simulated hands, where

the angles and placement of said first simulated hand uses said digitized measured signals and the angles and placement of said second simulated hand uses said modified signals and said first and second simulated hands are superimposed in the absence of said second simulated hand encountering said simulated impediment, said second simulated hand being depicted graphically as said simulated graphical hand;

whereby when said second simulated hand encounters said impediment, said second simulated hand is displaced from said first simulated hand and realigns with said second simulated hand when said impediment is removed at a rate regulated by said spring-mass-dashpot.

5. A system for moving a simulated graphical hand in relation to the movement of a physical hand, where the simulated graphical hand moves in a simulated environment comprising a simulated graphical impediment to free motion, where the physical hand moves in an environment lacking analogous physical impediments, said system comprising:

a device comprising goniometers for measuring the angles of the joints of a physical hand, a tracking device for measuring the spatial placement of said hand relative to an inertial reference frame and means for mounting said device on said physical hand, said device providing digitized measured signals associated with said angles and said spatial placement; and

a data processor, comprising data related to the spatial placement of said simulated impediment, for producing modified signals from said digitized measured signals using a simulated spring attached between first and second simulated hands, where the angles and placement of said first simulated hand uses said digitized measured signals and the angles and placement of said second simulated hand uses said modified signals and said first and second simulated hands are superimposed in the absence of said second simulated hand encountering said simulated impediment, said second simulated hand being depicted graphically as said simulated graphical hand;

whereby when said second simulated hand encounters said impediment, said second simulated hand is displaced from said first simulated hand and when said impediment is removed, becomes superimposed with said second simulated hand at a rate in proportion to the movement of said first simulated hand.

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6. A method for moving a simulated multi-articulated structure in a graphical environment, comprising an impediment to free motion, in relation to the movement of an analogous physical multi-articulated structure in a physical environment lacking said impediment, said method comprising steps of:

10 generating digitized signals representing the configuration and spatial placement of said physical structure and transferring said digitized signals to a data processor; and

in said data processor, recording the spatial placement of said impediment, generating modified signals from said digitized signals specifying the configuration and spatial placement of said graphical structure, and impeding the free motion of said simulated structure when said simulated structure encounters said impediment.

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7. A computer program product for use in conjunction with a computer system, the computer program product comprising a computer readable storage medium and a computer program mechanism embedded therein, the computer program mechanism, comprising:

20 a program module that moves a simulated multi-articulated structure in a graphical environment having an impediment to free motion in relation to the movement of an analogous physical multi-articulated structure in a physical environment lacking said impediment, the program module including instructions for:

generating first data representing the configuration and spatial placement of said physical structure; and

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recording the spatial placement of said impediment, generating modified second data from said first data specifying the configuration and spatial placement of said graphical structure, and impeding the free motion of said simulated structure when said simulated structure encounters said impediment.

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8. A system for moving a simulated structure in relation to the movement of an analogous physical structure, where the simulated structure moves in a simulated environment comprising a simulated impediment to free motion, where the physical structure moves in an environment lacking an analogous physical impediment, said system comprising:

10 a device measuring the configuration of the physical structure and the spatial placement of the physical structure relative to a reference frame and providing information associated with said configuration and spatial placement; and

15 a data processor receiving said information and modifying said information to generate a set of modified signals specifying the configuration and spatial placement of the simulated structure, whereby the free motion of the simulated structure is impeded when encountering said simulated impediment.